has collected fossils which are of triassic age; while the plants of the coal-basin of Hone-Gay have been referred to the Rhætian period. According to these observations the Trias is, in the interior, superposed upon the Carboniferous, while the coast coal-measures of infra-Liassic age rest directly upon the carboniferous limestone in one of its folds. The actual coal-beds do not appear to extend beyond Dong-Trieu, but the strata are more extensive, and it is not unlikely that detached portions of coal may be found among the hills of arkoses which rise out of the rice-fields of the Delta. The beds of coal are thick upon the level of the soil, very little above the sea, and near to it, but the quality of the combustible is inferior.

Cretaceous.—Paul Pelseneer (Bull. du Mus. Roy. d' Hist. Nat. de Belgique) describes certain remains of a macrurous crustacean found in the green sand of Grandpré, in the Ardennes. From the sum of its characters it is clearly an Astacomorph, and the form of its rostrum (without lateral spines) places it in the genus Hoplopariæ. The new species is named *H. benedeni.* Comparison of Hoploparia with Homarus and Nephrops induces M. Pelseneer to consider it nearly related to the former genus.

Pliocene.—Sir R. Owen has recently described two species of saurians, allied to Megalania, from remains found on Lord Howe's island. Smaller than *Megalania prisca*, and with some differential characters, they form the genus Meiolania. Both species are toothless, with modifications of the jaws suggestive of a horny beak, but the cranial and vertebral characters are sauroid. Three pairs of horn-cones are present, with feeble traces of a seventh more advanced medial horn. The tail is long and stiff, its vertebræ encased in an osseous sheath developing tuberous processes corresponding with the vertebræ. Lord Howe's island is an insular tract six miles by one mile, situated midway between Sydney and Norfolk island. It consists of three raised basaltic masses connected by low-lying grounds of blown coral-sand.

MINERALOGY AND PETROGRAPHY.[1]

PETROGRAPHICAL NEWS.—In the June number of the *Geological Magazine* Professor Judd has an interesting article[2] in which he treats of the structure and origin of the little glassy balls known as Marekanite, from their occurrence—the great Marekanka, near Okhotsch, in Siberia. A résumé is given of the work previously done on the subject and some additional observations are recorded. According to Judd the internal structure of marekanite balls differs from that of Prince Rupert's drops in that they contain volatile ingredients in such quantity that when heated the entire mass

[1] Edited by W. S. BAYLEY, Johns Hopkins University, Baltimore Md.

[2] On Marekanite and its Allies, p. 241.

swells up until it has attained eight or ten times its original bulk, when it assumes all the characteristics of a true pumice. Thin sections show under the microscope a flow structure. Devitrificative products are abundant, while porphyritic crystals are of small sizes, consisting almost entirely of hornblende, magnetite and a brown mica. From a consideration of all the facts and a comparison of similar occurrences of rocks in other localities, the author concludes that the tension which affects large rock masses manifests itself in the structure of the nuclei of perlitic masses. He further observes that the parting which produces columnar structure in rocks owes its origin to the contraction which takes place during cooling. The secondary system of curved cracks which gives rise to perlitic and similar structures are more probably due to the contraction which goes on as the volatile materials which they contain are slowly separated from them.——A very important contribution to the subject by regional metamorphism has recently been made by C. R. Van Hise,[1] who is working with Professor Irving on the Archæan rock of the Northwestern States. In this article the author gives in a very condensed form the result of his studies on the rocks of the Penokee-Geogebic iron-bearing series in Wisconsin and Michigan, and promises that a full treatment of the subject will appear later in a memoir by Professor Irving and himself. This formation extends in a general east and west direction for a distance of eighty miles through parts of Wisconsin and Michigan. It is younger than Keweenawan and in its upper members differs in different localities. The group consists principally of mica schists, black mica slates, graywackes and quartzites. In the eastern portion of the belt the predominent rocks are feldsparic quartzites, passing to the west into chloritic and biotitic graywackes, and finally into mica schists and black mica slates. According to the author "these rocks, at present of such widely varying character, microscopic study shows to have been originally in essentially the same condition. All were once, as some are still, completely fragmental rocks composed chiefly of quartz and feldspar, mingled in places with a little clayey matter, perhaps also with a small quantity of fragmental mica and some feerite. * * * The quantity of feldspar was apparently considerably greater in rocks of the western part of the area than in those of the eastern part." The quartzites, graywacke and graywackment slates are all indurated,[2] *i. e.*, the quartzes, and in some cases the feldspar fragments, have been enlarged by the deposition around them of interstitial quartz material, and accompanying this there has been an alteration of the feldspar into chlorite. The processes by which the mica schists and black slates have reached their present condition are much the same as the above,

[1] Upon the origin of the Mica Schists and Black Mica Slates of the Penokee-Geogebic Iron-Bearing Series. *Amer. Jour. Sci.*, XXXI, June, 1886, p. 453.

[2] Cf. Bulletin U. S. Geol. Survey, No. 8.

except that the feldspar, instead of changing into chlorite, has altered to muscovite and biotite, "the result being the production from a completely fragmental rock, by metasomatic changes only, of a rock which presents every appearance of complete original crystallization, and which would be ordinarily classed as a genuine crystalline schist." In order to show that there exists a regular gradation between the quartzites and mica schists, Van Hise describes the microscopical characteristics of fine slides, beginning with a muscovitic and biotitic graywacke, with enlarged quartz grains of clastic origin, to a muscovite biotite schist, which is apparently a typical mica-schist. A study of sixty slides shows that this regular gradation can be clearly traced from undoubted clastic rocks through graywackes to mica schists, which can not readily be distinguished from the ordinary schists to which a different origin can be attributed.——The metamorphic rocks of California have been studied by G. F. Becker,[1] and some remarkable results have been reached. Like the article of Van Hise's referred to above, this is also an abstract of a monograph of the U. S. Geological Survey. It gives the results of the study of thin sections of Californian rocks, and leaves the details to the monograph for elaboration. The rocks studied cover a belt of the coast ranges, 230 miles in length. The sedimentary rocks of the series are underlain by granite, from which they have been derived. Their most interesting alteration "consists chiefly in the metasomatic recrystallization of the sediments to holo-crystalline feldsparic rocks carrying ferro-magnesian silicates and in the formation of vast quantities of serpentine. It is also clear on structural and chemical grounds that solutions rising from the underlying shattered granite co-operated in the metamorphism." The microscope shows that the main constituents of the sandstones are quartz, biotite and hornblende, with the usual accessory minerals. The metamorphic rocks derived from these pass over into one another by degrees. For convenience the author divides these into *partially metamorphosed sandstones*, in which recrystallization has begun; *granular metamorphics*, consisting of a holocrystalline aggregate of augite, amphibole, feldspar, zoisite, quartz and accessory minerals; *glaucophane schists*, derived from certain shales much as the granular metamorphics are derived from the sandstones; the *phthanites*, calcareous schistose which have been subjected to a process of silicification resulting in chert-like masses; and finally the *serpentines*, which have resulted in part from the direct action of solutions on sandstones and in part from alteration of the granular metamorphics. The more important stages in the process of recrystallization can be traced under the microscope. One of the first stages is the resolution of the clastic grains into crystalline aggregates from which new minerals are

[1] Cretaceous Metamorphic Rocks of California. *Amer. Jour. Sci.*, XXXI, May, 1886, p. 348.

again built up. Several very remarkable instances of this are described. A further development of these processes yields rocks in which the fragmental character of their constituents can not be detected. These form the group of the granular metamorphics, which are subdivded into *amphibolites*, *metamorphic diorites* and *metamorphic diabases*, in which the pyroxene is sometimes diallage. Glaucophane and zoisite occur in most of the rocks of this class. The most interesting portion of the paper is that which treats of the origin of the serpentine. Field observations show that the mass of this rock is derived from the sandstones. Under the microscope it can be shown that all of the principal components of the sandstones and granular metamorphic rocks are subject to serpentinization. Grains of hornblende, augite, feldspar, apatite and *quartz* can be seen undergoing an alteration into serpentine. To account for the peculiar features of this widespread metamorphism the author supposes that at the time of the disturbances the water which the sandstones and granite contained was forced out in a heated condition. It was at first basic, and in its course converted some of the sandstones and shales into holo-crystalline augite and amphibole rocks. Serpentinization then followed at a lower temperature and finally silicification ensued, the solutions having now become acid.

MINERALOGICAL NEWS. — Argyrodite, the mineral in which Winkler has discovered the new element germanium,[1] has been described by Weisbach,[2] of Freiberg. It is found at the Himmelsfürst mine, near Freiberg, where it occurs in groups of little rounded crystals about one millimeter in length. They have a metallic luster; are steel-gray on crystal planes and reddish on fresh fracture surfaces; have a hardness of $2\frac{1}{2}$ and a specific gravity 6.085–6.111; are brittle and have no cleavage. The crystal system is monoclinic, the principal planes being ∞P, $P\grave{\infty}$, $-P\frac{2}{3}$, $6P\bar{\infty}$, $\frac{1}{3}P\bar{\infty}$ and occasionally $P\bar{\infty}$ and $6P\frac{2}{3}$. $a:b:c = 1:1.67:0.92$. $\beta = 70°$. Elbow-shaped twins and drillings are occasionally met with in which the twinning plane is at right angles to $6P\bar{\infty}$ and parallel to the combination edge $\infty P : P\grave{\infty}$. According to Winkler[1] argyrodite contains 73–75 per cent of silver. The percentages of sulphur and germanium have not yet been accurately determined.——A new variety of kobellite is mentioned by H. F. and H. A. Keller[3] from the mines of the Lillian Mining Co., Leadville, Col. The unaltered mineral is of a steel-gray color. It is fine grained, crystalline, with a metallic luster, and gives a black streak. An analysis of pure material yielded:

S	Pb	Bi	Ag	Cu	undissolved residue
15.23	44.08	33.27	5.66	trace	0.15

[1] Berichte der Deutschen Chemischen Gesellschaft, XIX, No. 3, p. 210.
[2] Neues Jahrb. f. Mineralogie, etc., 1886, II, p. 67.
[3] Ib., p. 79.

The formula corresponding to this composition is 3 (Pb, Ag_9) S Bi_2 S_3, which differs from that of kobellite [3 Pb S $(Bi\ Sb)_2$ S_3] in the absence of antimony.——W. Cross has recently[1] added topaz and garnet to the list of well-crystallized minerals found in the lithophyses of the rhyolite of Colorado. The occurrence of these two minerals had been referred to before by Mr. J. A. Smith,[2] but it has been left for Mr. Cross to give us a definite description of them and their paragenesis. The outer walls of the lithophyses as well as their concentric shells are primarily formed of sanidine in small stout crystals, of which the transparent ones possess a beautiful blue color[3] in the direction of the plane $\frac{15}{2} P \bar{\infty}$. In isolated crystals in these lithophyses clear, transparent, dark-red garnets occur. They have an average diameter of $2.5^{cm.}$ The planes $2O_2$ usually show a striation parallel to the dodecahedral edge. An analysis of selected material from parts of thirty crystals yielded Mr. L. G. Eakins :

SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	CaO	K_2O	Na_2O	H_2O
35.66	18.55	0.32	14.25	29.48	1.15	0.27	0.21	0.44

The mineral is a typical spessartite, an aluminous garnet in which the calcium has been replaced by manganese and ferrous iron. Topaz appears much less abundantly than garnet. Its crystals are prismatic, clear and transparent, either colorless, pale-bluish or distinctly wine-yellow. The usual forms are ∞P, $2 P$, $\infty P \breve{2}$, $0 P$, $2 P \breve{\infty}$, $4 P \breve{\infty}$, $\infty P \breve{\infty}$, $\infty P \breve{3}$, and $2 P \bar{\infty}$. The largest crystals measure half an inch in the direction of the brachy-axis ; the average diameter is about one-eighth of an inch. On closely comparing crystals obtained from open cavities with those found in the body of the rock, the former were seen to be colorless or of a pale-bluish tint, while the latter were most frequently wine-yellow. This difference is thought to be due to bleaching by sunlight, an effect which was noticed by Kokscharow[4] in the case of a wine-yellow topaz from the Urals. The paper closes with the results of the analyses of the only three rhyolites known to contain topaz in the manner described.——An analysis of a limonite pseudomorph after pyrite yielded Dr. E. G. Smith :[5]

SiO_2	S	FeO	Fe_2O_3	CaO	MgO	loss in ignition
6.25	0.31	0.91	80.21	0.04	0.40	11.72

——Mr. S. L. Penfield describes[6] brookite from Magnet cove, Arkansas, with a habit differing slightly from that usually seen on this mineral. The observed forms are $P \breve{2}$, $\frac{1}{2} P$, $\frac{1}{2} P \breve{2}$, $\infty P \bar{\infty}$, ∞P and $2 P \breve{\infty}$, with $\frac{1}{2} P$ predominating.

[1] American Journal of Science, XXXI, June, 1886, p. 432.
[2] Report on the Development of the * * * Resources of Colorado, 1881–2, p. 36.
[3] Bulletin U. S. Geol. Survey, No. 20, p. 75.
[4] Bull. Acad. St. Petersbourg, 4, 569, 1861.
[5] Amer. Jour. of Science, XXXI, May, 1886, p. 376.
[6] Ib., p. 387.

MISCELLANEOUS.—R. Brauns proposes[1] the use of methylene iodide as a means of separating the constituents of rocks. The specific gravity of the liquid is 3.33 at the ordinary temperature, varying from 3.3485 at 5° to 3.3045 at 25°. The author claims for this substance advantages over the heavy solutions now in such general use, while he recognizes at the same time the disadvantages of the necessity for the use of benzine in diluting (neither alcohol nor water can be used for this purpose). The physical properties of the substance are given in detail, and an experiment made to test its practicability as a medium for the separation of minerals of high specific gravity shows it to work very satisfactorily.

BOTANY.[2]

AIDS TO BOTANIZING.—The young collector prizes everything which will help him in his search for specimens and his efforts to prepare and preserve them in his herbarium. The last number (June) of the *Botanical Gazette* ought to satisfy every demand of the inquirer after the best botanizing methods. The general methods of making specimens are treated in notes and communications from ten different botanists. How to collect certain plants receives the attention of twenty-one specialists. The Gray Herbarium and the National Herbarium are described with some fullness, and the remaining pages are filled with numerous short notes, all bearing upon the general topic of the number. It is impossible to summarize the information brought together in this valuable series of communications. Perhaps the one fact most prominently brought out, is that good specimens are made by *care and painstaking*, rather than by following this or that particular method. The lesson of greatest importance to the beginner taught in this herbarium number, is that he must make *good specimens.* It is not enough to gather samples and dry them; the work must be well done—artistically done, one might almost say.

Another lesson which the young botanist will learn, is that botanizing, to-day, is somewhat enlarged above what the fathers knew and practiced it. Flowering plants, ferns, mosses, liverworts, lichens, fungi—big and little, seaweeds—from the sea itself and from the fresh water—all these are to be looked for, gathered, prepared, mounted, arranged.

The Botanical Collectors' Hand-book, published a few years ago by Professor W. W. Bailey, will also be found to contain much of value to the young collector. Many of the suggestions it contains will materially shorten the work of the beginner.

In the Bulletin of the Torrey Botanical Club, the subject of herborizing was well treated by Lyman Hoysradt eight years

[1] Neues Jahrb. f. Mineralogie, etc., 1886, II, p. 72.

[2] Edited by Professor CHARLES E. BESSEY, Lincoln, Nebraska.